SECTION 13914—WATER SPRAY DELUGE FIRE PROTECTION SYSTEM

PART 1--GENERAL

WORK INCLUDED: Work includes, but is not limited to:

Design, layout, fabricate, install, terminate, flush, and test a complete water spray fire protection system. Include pipe, fittings, spray nozzles, hangers, supports, earthquake bracing, expansion joints, deluge valve, control valve assemblies, alarm gongs, fire department connection, splash block, detection systems, fire detectors, wiring, control panel and all necessary accessories and components to assure a complete and operable system. The Subcontractor shall be responsible for coordinating all existing and new work. The Subcontractor shall install the new fire protection system in a craftsman-like manner.

RELATED SECTIONS:

Section 01300 Submittals
Section 09900 Painting
Section 13120 Pre-Engineered Metal Building
Section 13505 Underground Fire Water Distribution System
Section 13910 Wet Pipe Fire Protection System
Section 13911 Wet Pipe Fire Protection System
Section 16110 Electrical Raceways
Section 16120 Cable, Wire, and Connectors and Miscellaneous Devices
Section 16721 Fire Alarm and Supervisory (FA) System

REFERENCES:

The following documents, including others referenced therein, form part of this Section to the extent designated herein.

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

Uniform Building Code (UBC)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	Standard for the Installation of Sprinkler Systems
NFPA 15	Standard for Water Spray Fixed Systems for Fire Protection
NFPA 70	National Electrical Code
NFPA 801	Standard for Facilities Handling Radioactive Materials

FACTORY MUTUAL (FM)

FM Approval Guide	Fire Protection
FM Data Sheet 2-8	Earthquake Protection for Sprinkler Systems
FM Data Sheet 2-8N	Installation of Sprinkler Systems
FM Data Sheet 4-0	Special Protection Systems
FM Data Sheet 4-1N	Water Spray Fixed Systems for Fire Protection
FM Data Sheet 7-61	Radioactive Materials

UL Fire Protection Equipment Directory

Unless otherwise specified, references in this specification to other specifications, codes, standards, or manuals shall be the latest edition including any amendments and revisions in effect as of the date of this specification.

SYSTEM DESCRIPTION:

Reference Drawings: The reference drawings do not attempt to show complete details of the building construction that affect the fire protection installation. The drawings in part are diagrammatic and do not show all offsets, fittings, valves, equipment, etc. It is absolutely essential to study the architectural, structural, mechanical, and electrical drawings and confer with the various trades involved. To assure that there is no conflict between the fire protection system and the work of other trades and to assure that the owner secures the best arrangement of work consistent with the use of space.

Layout Piping and Fire Water Spray System:

This specification and the Regulatory Requirements outlined in Quality Control shall govern this layout.

The Subcontractor shall furnish all labor, materials, equipment, and supplies and perform all work and operations necessary to design and install a water spray fire protection system, including detection system and alarms, for the HEPA filter systems used in the HVAC system of the Treatment Building.

The design, pitching of pipe, and installation shall be performed per NFPA 15 and Factory Mutual data sheets 4-1N, 7-55, . The layout shall assure that the low points in the system are self draining.

The system shall use spray nozzles to provide a density of _____ gpm/sq. ft direct impingement on the _____surface of the _____. A hose stream allowance of 500 gpm shall be added at the base of the rise in the hydraulic calculations. The spray nozzles located around the _____(equipment) shall be balanced such that all heads are flowing ± 15% of each other. The piping shall be laid out to meet earthquake criteria using NFPA 13,15 and FM Data Sheet(s) 2-8, 2-8N, and 4-1N.

The water supply information available for use in the hydraulic calculations is a static pressure of __ psi with a residual pressure of __ psi flowing ___ gpm at _____. In general the maximum water velocity through the overhead sprinkler system shall not exceed 25 ft per second. The exception is for 2 in. and smaller line piping in a gridded system where the velocity shall not 20 ft per second. The final hydraulic requirements shall result in a water supply demand a minimum of 10% below the water supply curve.

Hydraulic calculations shall include all the necessary underground piping, fittings, and valves. The system riser shall be a minimum of 4 inch in diameter. The maximum water velocity through the sprinkler system shall not exceed 32 feet per second unless the section of piping involved is being used for throttling in order to balance the system.

Flushing Connections: N/A

Strainers: If nozzle diameter is less than or equal to ¼ inch, an adequate sized strainer shall be sized and installed.

Spray Nozzle Spacing: Nozzles shall be spaced as necessary to provide the design coverage and assure direct impingement of water spray on the design area.

Manual Discharge Station: A manual discharge device must be provided in an easily accessible area. Manual devices which actuate the automatic control valves may be mechanical, hydraulic, pneumatic, electrical, or other approved means. The manual device shall be amply strong to prevent breakage. Manual controls shall not require a pull of more than 40 pounds (force) [178 N] nor a movement of more than 14 inches (356 mm) to secure operation.

Piping: All above ground piping used in this project for water spray systems shall conform to the Product section of this specification. All exposed piping shall be labeled all other piping shall be labeled as a minimum. Piping leading from the fire department pumper connection to the first check valve, piping leading from the connection to the underground main, to the backflow preventer, and all other piping, which is open to the atmosphere shall be galvanized piping.

Concrete Block Anchors: Anchors for attaching to the building concrete block walls shall be installed in the grout filled blocks to the maximum extent possible. Where this is not possible, connection to the hollow block will be acceptable if the anchor used is rate for this type of installation. Regardless of the method used the loads on the anchor shall not exceed the allowable load for the anchor.

Seismic Bracing: Earthquake sway bracing shall be provided based upon **FM 2-8 using a "G" factor of 0.5**. Calculations, using the zone of influence method, showing the forces on the attachments shall be done to verify that the minimum requirements outlined are not exceeding the allowable strengths of listed equipment or allowable strength of the building

structure at the point of attachment. Details of the sway bracing shall be provided on the shop drawings and bracing calculation sheets.

The subcontractor shall be responsible for coordinating with the building manufacture to assure the structure is capable of supporting both the static and dynamic loads imposed by the automatic sprinkler system layout. The forces developed at the point of connection to the structure must be taken into account and approved by the building structural designer.

Piping installed such that it is supported by laying directly on the building structural members or trapeze shall be secured in place to resist vertical moment as if it were hanging from the same members or trapeze. Exceptions will be allowed on a case by case basis with the concurrence of the Facility Fire Protection Engineer.

Hangers: Layout shall be based upon pressures in excess of 100 psi. Hangers attaching to steel purlins shall be attached by connecting into the web of the purlin using side beam brackets.

Flushing Connections: Flushing connections shall be provided as required.

Sleeves and Penetrations: All pipes penetrating concrete or masonry walls or floors shall be sleeved. Sleeves shall be caulked to retain the proper fire wall rating and to prevent water entry from outside the building or between floors with an approved sealant. Sleeves shall extend 1 in. above the finished floor. Pipe penetrations shall have clearances as outlined in NFPA 13. Penetrations thru exterior walls shall be sealed with a weather tight assembly.

Water Spray Nozzles: Spray nozzles shall be approved by both Factory Mutual and UL.

Control Valves: All valves controlling fire protection water supplies shall be provided with valve supervision capabilities.

Test Connections: Test connections shall be installed for ease of testing at an accessible area.

Low Point Drains: Low point drains shall be arranged to allow system drainage without the use of ladder. The drains shall discharge to a safe location, preferably to the exterior of the building, if at all possible. Drain valves shall consist of 1/4 turn ball valves.

Splash Blocks: The Subcontractor shall furnish splash blocks at the main drain, inspector's test connection, and all other exterior discharge locations that do not drain onto asphalt or concrete.

Layout of the Detection System:

SYSTEM DESCRIPTION: One integrated fire control cabinet with continuous linear sensor and one battery backup shall be provided to detect and annunciate fires and supervise and activate the water spray fire suppression system.

Detection shall be by means of one (1) continuous linear wire type sensors installed in the duct per HEPPA filter protection standard and one (1) heat detector located inside the riser room. The detection circuit in the duct shall monitor for two distinct fixed temperature set points, one pre-alarm and one alarm. All detection circuits shall be supervised for open and shorts. Output contacts for alarm and trouble condition shall be provided and connected along with contacts that operate the deluge valve.

The system shall have battery backup capable of supplying 60 hours of power with the system in the standby state followed by 10 minutes of power with the system in the full alarm state.

REQUIREMENTS:

Material and equipment shall be of latest design and shall be designed and engineered for the detection of fires involving or exposing the transformers. Material and equipment shall be of a manufacturer regularly engaged in the design of equipment for this specific hazard type.

All equipment supplied shall be U.L. listed and F.M. approved for fire protection.

THERMAL DETECTORS:

Heat detection sensors shall resist corrosion and with stand the environmental conditions associated with being exposed to the elements, in the duct. The detector located in the riser house shall be a vertical rate compensated detector with a temperature setting of approximately 190oF.

The detectors shall be F.M. approved and U.L. listed.

DESIGN AND CONSTRUCTION

The continuous linear thermal wire sensor shall be a small diameter coaxial wire which is capable of sensing temperature changes along its entire length. The sensor shall be constructed of a center conductor and outer inconel 625 steel sheath. The center wire and outer sheath shall be terminated using water tight monel type connectors. The center conductor is electrically insulated from the outer sheath by a ceramic thermal material. The thermal wire shall have a negative coefficient of resistance that will decrease exponentially as the surrounding ambient temperature increases.

The thermal wire detector shall have the capability to allow the control equipment to provide, two (2) independent field adjustable set points. These set points shall be pre-alarm and alarm.

The thermal wire detector shall be capable to withstand temperature extremes from –50F to 2000F. Non-restorable, fusible one use linear wires are NOT acceptable.

The thermal wire detector shall be manufactured in twenty five (25) and fifty (50) foot sections using a single male and single female threaded military grade connector at each end. Each thermal wire detector assembly shall be provided in the proper length for the fire zone.

The thermistor detector is to be preassembled at the factory to form the lengths required by the detection layout. All mating connectors are to be torqued to factory specification, and have a tamper proof sleeve placed over the assembled connector.

All final assemblies shall be factory tested prior to shipment.

The detection system shall be Alison Control 9090-13 Series continuous line type thermistor sensor or an approved equal.

FIRE ALARM CONTROL PANEL REQUIREMENTS

The fire alarm control panel shall be Alison Series A888, housed in a NEMA 12 enclosure or approved equal. All circuitry shall be listed for a temperature range of -40F to 120F.

Exterior shall be red polyurethane with manufacturers standard finish and surface preparations.

Internal panel shall be white enamel, with manufacturer's standard finish and surface preparation.

A lockable power on/off switch shall be provided exterior to the cabinet to disconnect primary power and a on/off switch shall be provided interior to the panel to disconnect secondary power.

Power supplies which convert incoming line voltage to system low voltage shall be protected by fuses or circuit breakers on the line side. Power supplies shall be current limited.

All fire detection panel circuits interfacing to devices outside the control panel shall be fused or current limited such that a short circuit in the wiring to the device will not damage the fire control panel. Fuses and circuit breakers shall be located inside the control panel.

The front of the control panel shall also contain the following indicators:

PRE-ALARM (PER DETECTION CIRCUIT)
ALARM (PER DETECTION CIRCUIT)
DETECTION TROUBLE (PER DETECTION CIRCUIT)
DELUGE VALVE SOLENOID Actuated
SOLENOID TROUBLE MANUAL ACTUATION
SYSTEM NORMAL
BATTERIES IN USE
BATTERY TROUBLE

BATTERY VOLTAGE LOW

The front of the control panel shall contain the following push button switches.

LAMP TEST
ACKNOWLEDGE
SYSTEM RESET

All indicators and switches shall be labeled. They shall be grouped by zone. Name plates shall be provided with specific hazard identification.

Interior major components shall have labels identifying their associated reference numbers which appear on the fire control panel mechanical outline drawing and schematic diagram.

Connection of all interconnecting wires shall be by means of terminal blocks. The terminal blocks shall be Marathon Series 300 and shall be rated for 300 volts 30 amps minimum. Adequate space adjacent to the terminal blocks shall be provided.

Fire control panel wiring shall be 300 volt, tefzel insulated, stranded copper wire. Insulation shall be heat, moisture, chemical and flame resistant. PVC insulation shall not be used.

All internal wiring shall be neatly bundled and shall be secured using cable ties at regularly spaced intervals. Bundles shall be fastened to the interior panel as required. Wiring across hinged doors shall be properly strain relieved.

Screw type wire terminations shall make use of compression type ring terminal connectors which firmly grip the conductor and which have insulated sleeves. Crimp connections shall be made using a rachet type crimping tool. Solder connections to printed circuit type connectors shall be permitted.

Indicators and switches shall be Cutler Hammer E30 Series or approved equals. Push button switches on the front of the control panel which are used for system reset or actuation of an extinguishment system shall be guarded.

Interior construction of the panel shall be such that printed circuit cards, modules and relays can be easily replaced. It shall not be necessary to remove the interior panel to replace any component.

Relays, unless otherwise specified in this document for specific functions, shall be rated for 10 amps at 120 VAC resistive load and 0.4 amps at 120 VDC resistive load.

The F.M. and U.L. label shall be located on the interior of the front door.

BATTERY CABINET CONSTRUCTION REQUIREMENTS:

Batteries shall be housed in a separate NEMA 12 enclosure. Batteries shall be U.L. or F.M. listed for use with the manufacturer's listed fire control cabinet.
Exterior shall be red polyurethane with manufacturer' 5 standard finish and surface preparation.

Interior panel shall be white enamel, with manufacturers standard finish and surface preparation.

Batteries shall be sealed lead acid type. Capacity shall be such that the system will operate under full normal power for 24 hours followed by 10 minutes of all circuits in alarm.

Batteries shall be supervised by the Fire Detection Control panel for low voltage and for open circuited purchaser interconnection wiring.

Batteries shall be protected by a circuit breaker which shall also serve as the main disconnect.

Connection of incoming wires shall be by means of barrier type terminal strips.

All internal wiring shall be neatly bundled and shall be tywrapped at regular intervals.

The F.M. or U.L. label shall be located on the interior of the front door.

FIRE DETECTION CONTROL PANEL LOGIC:

PRE-ALARM RESPONSE - When a pre-alarm condition is detected an amber "PRE-ALARM" indicator will begin flashing, the internal audible alarm will sound and the pre-alarm contact will transfer.

ALARM RESPONSE - If the temperature of the line type sensor continues to rise until the alarm level is reached or the rate compensated detector activates, the red "ALARM" indicator will begin flashing, the internal audible alarm will sound (if previously silenced), an SPDT System Alarm Output Contact will transfer and the deluge solenoid will be actuated.

When the acknowledge switch is pressed, the lamps will stop flashing and remain on continuously until the alarm condition is cleared and the "SYSTEM RESET" or "ALARM RESET" switch is pressed.

The internal audible alarm will be silenced when the acknowledge switch is pressed but will resound for a subsequent alarm condition.

DETECTION SYSTEM SUPERVISION:

The following items shall be supervised:

1. Integrity of the wiring from the control unit to the sensor junction boxes.
2. Open or shorted sensors or terminators.
3. Deluge valved solenoids.
4. Manual actuate circuits.
5. The presence of the systems primary input power.
6. The integrity of the battery backup interconnection.
7. Battery backup over voltage or under voltage conditions.
8. The presence of the internal operating voltage.

Any trouble condition indicated above shall cause the following to occur:

1. A normally illuminated green system normal indicator located on the front panel shall turn off.
2. A white indicator located on the front panel which identifies which parameter has malfunctioned, will begin flashing. The indicators shall go on steady when the "ACKNOWLEDGE" button is pressed.
3. One form "C" system trouble output contact which is maintained transferred in the system normal condition changes state. This contact shall be rated for 10 amperes at 120 VAC, resistive load.
4. The internal trouble buzzer will sound. The buzzer may be silenced by depressing the "ACKNOWLEDGE" button on the control unit.

The above supervisory response shall be latching with all parameters returning to their system normal condition when all malfunctions have been removed and the "SYSTEM RESET" button is pushed. This will cause the "SYSTEM NORMAL" indicator to relight.

After the audible trouble alarms have been silenced they may be re-energized by a subsequent trouble condition. The audible trouble alarm shall be non-latching and shall reset automatically after all trouble conditions have cleared.

FIRE DETECTION CONTROL PANEL SWITCHES:

LAMP TEST: A switch shall be provided on the fire detection control panel to test lamp integrity.

ACKNOWLEDGE: A push button shall be provided on the fire detection control panel to transfer flashing indicators to a steadily on state and silence internal trouble and fire alarm audible.

RESET: A guarded push button shall be provided on the fire detection control panel to reset all latching functions. If a valid alarm condition exists after release of the push button, the control panel shall initiate the proper response.

ALARM RESET: A guarded push button for each detection circuit shall be provided on the Fire Detection Control Panel to reset the pre-alarm, alarm response of that circuit.

SUBMITTALS:

Shop drawings for both the water spray and detection system installation, fire control panel mechanical outline drawing and schematic diagram, catalog data, hydrostatic test procedure, flushing procedure, Certificate of Completion, and Contractors Material and Test Certificate shall be submitted as outlined on the Vendor Data Schedule.

Requirements:

The fire water spray suppression system layout, including the detection and actuation system, shall be submitted as a complete bound package for review. A complete package shall consist of all working plans, hydraulic calculations, sway bracing calculations, and other vendor data required by this specification. Working plans shall contain all information required by NFPA 13, 15, FM 2-8, 2-8N , 4-1N, and include an outline showing all ductwork. Partial submittals will be considered as incomplete and will not be reviewed. The layout must be reviewed and receive an authorization to proceed by the Contractor prior to beginning of installation.

Provide the following detailed information on the drawings for the new panel.

- Enclosure type and size.
- Battery size and type including amp-hour rating.
- Panel total loading in alarm and normal condition.
- Circuit feed identification of 120V supply.
- End of line device values.
- Part number and manufacture number of all equipment.

In addition, the design shall be by a person with a minimum of a Level IV National Institute for Certification of Engineering Technologies (NICET) Certification in special hazard fire protection system design. Proof of certification shall be provided with the design package.

The Subcontractor shall submit all layout drawings for review and authorization to proceed prior to construction. All drawings shall be CAD generated and completed on size D (22 x 34 in.) drawings. Lettering size shall be a minimum of 1/8 (.125)" inch for all lettering on the main body of the drawing. Border and title block shall follow format in this drawing package. An electronic copy in AutoCAD, DWG format, shall be furnished in addition to the original drawing plots. Electronic copies of border and title block format is available upon request. An A/E Drawing Standard format is available upon request.

Label List: The subcontractor shall provide a list of labels associated with the new fire alarm system for approval prior to installation. The list shall include labels for fire alarm panels, terminal boxes, and alarm devices. The label lists shall be submitted for review and approval prior to installation specifying where they will be used. The Subcontractor shall install wire labels on all cables.

Pre-acceptance Test Procedure: The Subcontractor shall submit an acceptance test document for each system that will be used to verify proper operation of all new fire alarm equipment. The acceptance test shall include as a minimum, the manufacturers start up procedures, acceptance procedures, and requirements listed in NFPA 72.

The pre-acceptance test document shall be submitted to the Contractor's Representative for review and approval prior to use.

Certificate of Completion: The Certificate of Completion as outlined in NFPA 72 shall be completed and accepted prior to final acceptance of the installation.

One set of approved fire protection design drawings shall be maintained on the project site during construction. The Subcontractor shall redline all changes daily. The redline drawings shall be incorporated on the "as-built" design drawings by the Subcontractor.

As-built drawings in both hard copy and electronic shall be submitted. Additionally electronic and hard copy As-built hydraulic calculations, compatible with HASS 7.1 shall be submitted with the drawings.

Quality Control Submittals:

Procedures: The Subcontractor shall submit a hydrostatic test procedure and a detailed job specific flushing procedures. The flushing procedure shall outline where the flushing water will be obtained and how it will be disposed of in a safe manner. It shall also outline how the flow will be monitored to assure adequate flow and how long the flow must be maintained to adequately flush the piping. This procedure must be submitted for review prior to any connections to existing plant piping.

Certifications: A Contractor's Material and Test Certification for Above-Ground Piping shall be completed and accepted, for each major portion of the work covered by this specification prior to final acceptance of the installation.

Test Reports: A final inspection form shall be submitted for the automatic sprinkler system installed or modified by this project. See Attachment 2 of this section for acceptance forms to be submitted.

Building Manufacture Letter: A letter from the steel building manufacture approving the method, location, and forces used in the attachment of earthquake sway bracing.

See Section 01300, Submittals and the Vendor Data Schedule for additional submittal requirements.

QUALITY CONTROL:

The sprinkler contractor for the fire water spray system shall have a NICET Certified Engineering Technician, (CET), in Fire Protection with a minimum Level III rating or a Professional Engineer, (PE), in Fire Protection responsible for overseeing the preparation of the layout drawings and installation. This person shall be required to certify that the drawings are in accordance with this specification and all referenced regulatory requirements. All drawings shall be signed by the CET or stamped by the PE.

Manufacturers: Firms regularly engaged in the manufacture of fire protection equipment and piping accessories of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 yrs.

Installer: A firm with at least 3 yrs of successful installation experience on projects with fire sprinkler piping similar to that required for this project. The installing subcontractor shall be licensed, by the State of Idaho as a Fire Protection Sprinkler Subcontractor.

UL Listed or FM Approved: Provide fire protection system piping, fittings, and devices with a UL listing and FM approval unless supplying the as specified product.

Exceptions will be made on a case by case bases for products submitted as Or Equals. If no product exists that has both a UL listing and FM Approval, it will be acceptable to use a product that has been published in either organizations publications.

Regulatory Requirements (Codes and Standards): Comply with the provisions of the following codes and standards unless otherwise specified herein.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	Standard for the Installation of Sprinkler Systems
NFPA 15	Standard for Water Spray Fixed Systems for Fire Protection
NFPA 70	National Electrical Code
NFPA 801	Standard for Facilities Handling Radioactive Materials

FACTORY MUTUAL (FM)

FM Approval Guide Fire Protection
FM Data Sheet 2-8 Earthquake Protection for Sprinkler Systems
FM Data Sheet 2-8N Installation of Sprinkler Systems
FM Data Sheet 4-0 Special Protection Systems
FM Data Sheet 4-1N Water Spray Fixed Systems for Fire Protection
FM Data Sheet 7-61 Radioactive Materials

Notification: The fire alarm Subcontractor shall notify the Contractor in writing two weeks prior to beginning work. The Subcontractor shall not connect into or modify any part of the existing fire alarm system unless authorized by the Operating Contractor's Representative. See construction coordination schedule in Appendix A.

Final Connection To Existing Systems: The Subcontractor shall have the Contractor's Representative present during all tie-ins to the existing plant fire alarm and emergency notification systems.

Workmanship: All work shall be done in a skillful and workmanlike manner. The Subcontractor shall do all construction work associated with the installation of equipment. No modifications or rearrangements, not shown on the drawings, shall be made without prior approval from the Contractor. After the equipment is installed, all wiring in enclosures shall be neatly secured in place by cable ties. Conductors in cabinets shall be carefully formed and harnessed.

Terminal lugs shall be crimped to conductors with a calibrated crimping tool. The crimping tool shall be compatible with lugs being crimped.

Upon completion of the automatic fire water spray system installation, the individual with the NICET level III or equivalent certification, or the PE responsible for the system layout, shall conduct the final main drain test and verify the installation has been installed in accordance with the working drawings and meets the layout requirements of this specification.

DELIVERY, STORAGE AND HANDLING:

All materials shall be delivered to and stored at the job site in a manner which will prevent foreign material from getting inside the piping and valving.

SEQUENCING /SCHEDULING:

The static and dynamic loads associated with the fire protection system must be coordinated with the building structural design.

The underground fire water main must be flushed and accepted prior to connection to the sprinkler system riser.

SITE CONDITIONS: This is a new construction site at the INEEL.

PART 2--PRODUCTS

MATERIALS AND EQUIPMENT:

Piping: Piping shall be welded or seamless galvanized steel, Schedule 40, conforming to the requirements set forth in NFPA 15. Thin wall and Schedule 10 piping is not acceptable.

Pipe Fittings: Fitting shall be hot dipped galvanized in accordance with the requirements set forth in NFPA 15. Reduction in pipe size shall be made with one-piece reducing fittings. Bushings will not be acceptable. Plain-end fittings are not acceptable.

Welded fittings on galvanized piping will not be allowed unless the weld effected zone of the fitting and associated piping is hot dip galvanized.

Stainless steel fittings shall be 304, ASTM 351 in accordance with the requirements set forth in NFPA 13 and FM 2-8N. Reduction in pipe size shall be made with one-piece reducing fittings. Bushings are not acceptable.

Pipe Couplings:

Flexible galvanized couplings in pipelines shall be UL listed or FM approved and they shall be in conformance with NFPA 15 using Victaulic, Style 75, or approved equal. The grooving machine used to prepare the piping to except the flexible couplings shall be approved for use with the coupling by the coupling manufacture.

Rigid couplings in pipelines shall be Victualic Style 005, 07, or approved equal. The grooving machine used to prepare the piping to except the flexible couplings shall be approved for use with the coupling by the coupling manufacture.

Plain end and welded couplings shall not be allowed

Spray Nozzles: Spray nozzles shall be of an open head design with nominal nozzle size as detailed on the drawings Dust plugs shall be provided for each nozzle. Nozzle selection shall take into account the potential for high winds.

Spare Nozzles: The Subcontractor shall furnish spare nozzles in accordance with NFPA 13 for spare heads with a nozzle wrench in a wall-mounted metal cabinet adjacent to the riser. Cabinet shall have a hinged cover. Subcontractor shall provide the spare sprinkler cabinet.

Fire Department Connections: Shall be of the siamese type, 2½ x 2½ x 4 in. and shall have two 2½ in. female swivel connections with National Standard fire hose threads. The fire department connections shall be Potter-Roemer Model 5710 or approved equal. Two 2½ in.

plugs shall be included and shall be Potter-Roemer Model 5950 or approved equal. An identification plate labeled "AUTOSPKR" shall be provided.

Deluge Valve: The deluge valves shall be complete with trim and associated equipment. The two valves shall be Viking Model E or approved equal. Riser valve and piping shall be a minimum of 4 in. The valve shall be trimmed to allow for release using the detection system outlined in part 4 of this section.

Riser Block Valves: Riser block valves shall be UL listed or FM approved valves. Each valve shall include an approved position supervisory switch that can be connected normally open or normally shut.

Butterfly Valve: A butterfly valve with weather proof actuator housing, have a positive indication for the open and closed position, and be prewired for valve supervision. It shall be Victaulic Series 708-W or approved equal.

Outside Screw and Yoke (OS&Y): Valves shall be UL listed and FM approved. American Flow Control, Series 500 or approved equal.

Electric Bell: The electric bell shall be Potter PBD Series or approved equal with BBK-1 Weatherproof backbox, unless otherwise directed by the cognizant Fire Protection Engineer.

Water Flow Pressure Alarm Switch: Pressure type water flow alarm switch with built in recycling pneumatic retard and two sets of SPDT contacts shall be provided as part of the Alarm Valve trim. Potter-PS10-2 Pressure Type Flow Switch or approved equal.

Hydraulic Data Placards: Hydraulic data placards shall be metallic and have the required information permanently stamped or embossed. The use of markers or tape will not be allowed. Subcontractor shall supply, fill in all the required information, and install the placards on the system riser.

Concrete Block Anchors:

Grout-filled: Anchors shall be a rated for ASTM C90, concrete block, filled with 2000 psi grout conforming to ASTM C474. Hilti model HIT HY 150 Injection Adhesive Anchor or HVA Adhesive System.

Hollow Block: Anchors shall be approved for use in ASTM C90, type II, hollow concrete block. Hilti model Sleeve Anchor or approved equal.

Pipe Stands: Pipe stands shall be adjustable and have a pipe saddle. Tolco Fig. 319 with Fig. 317 saddle or approved equal

Check Valves:

Swing Check: Swing check valves shall have a removable faceplate to allow for maintenance of the valve without the need of removing it from the system. Viking model G-1 or approved equal.

Wafer Check: Wafer check valves shall contain an o-ring sealed clapper, torsion spring loaded, and be of the butterfly valve type. Grinnell, Model F512 or approved equal.

Hangers: Hangers shall be of the type and location which is in accordance with NFPA 13 and 15.

Threaded side beam brackets, TOLCO Fig. 58 or approved equal with bolt and hex nut fastener.

C-Type beam clamps with retaining strap, TOLCO Fig. 65, 66, or approved equal. Retaining strap TOLCO Fig. 69 or approved equal.

Ring Hanger, TOLCO Fig. 2, 2NFPA, and 200 or approved equal.

Surge Restrainer: TOLCO Fig. 25 or approved equal.

Straps: Straps shall be UL Listed and FM approved, ¼" bolt holes, Carbon Steel. Grinnell Short Strap, Fig. 262 or approved equal.

Earthquake and Sway Bracing: Bracing shall be UL listed or designed by a registered Professional Engineer in the State of Idaho. TOLCO or approved equal.

Signs: All drain and test valves shall have identification signs per NFPA 13. Lettering shall be a minimum of ½ in. high white letters on red background.

Splash Block: Splash blocks shall be constructed of concrete.

EQUIPMENT AND DEVICE LABELS:

Alarm device number shall include alarm type and address shall be labeled with 1/8 in. letters.

Labels shall be made upon red engraved laminated phenolic resin nameplates with white lettering. Labels for equipment shall be permanently installed by gluing, chaining, or screwing them to the equipment.

All terminal box numbers and panel numbers shall be labeled with 1/8 in. high letters.

Power Labels: Red laminated labels shall be installed on the door of panels that have 120V feeds to equipment identifying the power panel and breaker number. Lettering shall be 1/8 in. high.

Training: The fire alarm panel manufacture shall supply factory authorized certification training on the fire alarm and network reporting system associated with the identified fire alarm system including installation, hardware, maintenance, and repair for four (4) engineering personnel. Notify Contractor 10 working days in advance of training to allow notification and reserve a room.

PAINTING AND IDENTIFICATION OF PIPING

See Section 09900 Painting, for the requirements of painting and labeling all pipe, fittings, hangers, and devices. Galvanized or stainless steel piping need not be painted but shall be labeled.

PART 3--EXECUTION

FIELD QUALITY CONTROL:

Installation: Only new and approved sprinklers, piping, fittings, hangers, and devices shall be employed in the installation of the sprinkler system.

One set of approved fire protection layout drawings shall be maintained on the project site during construction. The Subcontractor shall redline all changes daily. The redline drawings shall be incorporated on the "as-built" layout drawings by the Subcontractor.

Stainless steel screwed fittings shall utilize TEFLON tape and/or TEFLON paste to prevent galling.

Welding: Welding shall be done in accordance with NFPA 15. All weld areas shall be hot dip galvanized to assure adequate corrosion protection. Spray or paint on galvanization will not be acceptable to repair galvanization damaged by welding.

QUALITY CONTROL TESTING:

Subcontractor Supplied Testing:

Test Report: Provide a tests report for each panel and system.

Resistance Measurements: Resistance measurements of all conductors shall be made with an analog meter with an input impedance of 20K ohm per volt or greater. A digital meter SHALL NOT be used to make resistance measurements. Measurements shall be read with the meter on the most appropriate scale so needle deflection is as close to mid scale as possible.

List the conductors tested on a Subcontractor furnished test data submittal sheet.

Meggering Testing: Prior to terminating, test cable or wire of 25 ft or longer for insulation resistance with a megger (500 V megger for 300 V insulation). Any conductor with less than 10 megohms to ground shall be replaced before proceeding with the terminating. List the conductors tested on a Subcontractor furnished test data submittal sheet. Note: No meggering test shall be performed with wiring connected to transient eliminators, modules or panels.

Preacceptance Testing: The Subcontractor shall conduct the acceptance using the approved acceptance test document.

The preacceptance test will verify that all equipment has been installed properly and is operable before connecting it to the existing fire alarm systems. Adjustments and settings to achieve correct operation will be made as necessary during the preacceptance test. Completed preacceptance test document shall be submitted to the Contractor's Representative after the test.

Acceptance Tests:

Flushing of Piping: New underground mains and lead-in connections to system risers shall be flushed thoroughly immediately after tie-in to system is made or before connection is made to the sprinkler piping. Reference NFPA 13. Testing and flushing shall be witnessed by the Contractor's Representative.

Hydrostatic Testing of System Piping: All new fire system piping shall be hydrostatically tested at not less 225 psi pressure for two (2) hours with no visible leakage following an approved procedure. Reference NFPA 13. The procedure shall be provided as outlined in the Vendor Data. All leaks shall be repaired and system retested. Plugs shall be used for testing the sprinkler piping and shall be replaced with sprinkler heads after testing has been accepted. Reference NFPA 13. Testing and flushing shall be witnessed by the Contractor's Representative.

Water Discharge Test:

A full flow discharge test shall be preformed on the transformers. The spray nozzles shall be adjusted as necessary to assure complete coverage of the transformers. This test shall be witnessed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

CLEANING:

Flushing of Piping: New underground mains and lead-in connections to system risers shall be flushed thoroughly immediately after tie-in to system is made or before connection is made to the sprinkler piping.

Fire Protection Pipe Flushing Procedure: Upon completion of installation, the system shall be filled and drained at least two (2) times. Water shall be run through the inspectors test connection or auxiliary drain until water flows clear. Testing and flushing shall be witnessed by the Contractor's Representative. System shall be left in a drained condition.

END OF SECTION 13914

Attachment 1

Contractor's Material & Test Certificate

CONTRACTOR'S MATERIAL AND TEST CERTIFICATE FOR ABOVEGROUND PIPING

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A[illegible]ate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood th[illegible]'s representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

Property Name	**Date**

Property Address

PLANS	Accepted by approving authorities (names)	
	Address	
	Installation conforms to accepted plans	Γ YES Γ NO
	Equipment used is approved.	Γ YES Γ NO
	If no, explain deviation	
INSTRUCTIONS	Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment? If no, explain	Γ YES Γ NO
	Have copies of the following been left on the premises:	
	1. System Components Instructions	Γ YES Γ NO
	2. Care and Maintenance Instructions	Γ YES Γ NO
	3. NFPA 25	Γ YES Γ NO
LOCATION OF SYSTEM	Supplies Buildings	

SPRINKLERS

Make	Model	Year of Manufacture	Orifice Size	Quantity	Temperature Rating

PIPE AND FITTINGS

Type of Pipe
Type of Fittings

ALARM VALVE OR FLOW INDICATOR

Alarm Device			Maximum Time to Operate Through Test Connection	
Type	Make	Model	Minutes	Seconds

DRY PIPE OPERATING TEST

Dry Valve			Q.O.D.		
Make	Model	Serial No.	Make	Model	Serial No.

	Time to Trip Thru Test Connection*		Water Pressure	Air Pressure	Trip Point Air Pressure	Time Water Reached Test Outlet*		Alarm Operated Properly	
	Min	Sec	psi	psi	psi	Min	Sec	Yes	No
Without Q.O.D.									
With Q.O.D.									

If no, explain

DELUGE & PREACTION VALVES

Operation Γ Pneumatic Γ Electric Γ Hydraulic

Piping Supervised Γ YES Γ NO | Detecting media supervised Γ YES Γ NO

Does valve operate from the manual trip and/or remote control stations Γ YES Γ NO

*Measured from thime inspector's test connection is opened.

DELUGE & PREACTION) VALVES (continued	Is there an accessible facility in each circuit for testing Γ YES Γ NO				If no, explain			
	Make	Model	Does Each Circuit Operate Supervision Loss Alarm		Does Each Circuit Operate Valve Release		Maximum Time to Operate Release	
			Yes	No	Yes	No	Min	Sec
PRESSURE REDUCING VALVE TEST	Location & Floor	Make & Model	Setting	Static Pressure		Residual Pressure (Flowing)		Flow Rate
				Inlet (PSI)	Outlet (PSI)	Inlet (PSI)	Outlet (PSI)	Flow (GPM)
TEST DESCRIPTION	Hydrostatic: Hydrostatic test shall be made at not less than 200 psi (13.6 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.2 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped.							
	Pneumatic: Establish 40 psi (2.7 bars) air pressure and measure drop which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours. Test pressure tanks at normal water level and air pressure and measure air pressure drop, which shall not exceed 1-½ psi (0.1 bars) in 24 hours.							
TESTS	All piping hydrostatically tested at ___ psi for ___ hrs. Dry piping pneumatically tested Γ YES Γ NO Equipment operates properly Γ YES Γ NO				If no, state reason			
	Do you certify as the Sprinkler Contractor that additives and corrosive chemicals, sodium silicate or derivatives of sodium silicate, brine, or other corrosive chemicals were not used for testing systems or stopping leaks? Γ YES Γ NO							
	Drain Test	Reading of gage located near water supply test connection: ___ psi			Residual pressure with valve in test connection open wide ___ psi.			
	Underground mains and lead in connections to system risers flushed before connection made to sprinkler piping. Verified by copy of the U Form No. 85B Γ YES Γ NO Other Explain Flushed by installer of underground sprinkler piping Γ YES Γ NO							
	If powder driven fasteners are used in concrete, has representative sample testing been satisfactorily completed Γ YES Γ NO						If no, explain	
BLANK TESTING GASKETS	Number Used		Locations		Number Removed			
WELDING	Welded Piping Γ YES Γ NO If Yes...							
	Do you certify as the Sprinkler Contractor that welding procedures comply with the requirements of at least AWS D10.9, Level AR-3						Γ YES	Γ NO
	Do you certify that the welding as performed by welders qualified in compliance with the requirements of at least AWS D10.9, Level AR-3							
	Do you certify that welding was carried out in compliance with a documented quality control procedure to ensure that all discs are retrieved, that openings in piping are smooth, that slag and other welding residue are removed, and that the internal diameters of piping are not penetrated						Γ YES	Γ NO
							Γ YES	Γ NO
CUTOUTS (DISCS)	Do you certify that you have a control feature to ensure that all cutouts (discs) are retrieved? Γ YES Γ NO							
HYDRAULIC DATA NAMEPLATE	Name Plate Provided Γ YES Γ NO				If no, explain			
REMARKS	Date left in service with all control valves open:							
SIGNATURES	Name of Sprinkler contractor							
	Tests Witnessed By							
	For Property Owner (Signed)		Title		Date			
	For Sprinkler Contractor (Signed)		Title		Date			

Additional Explanation and Notes

Attachment 2

FINAL INSPECTION FORM

INEEL FIRE PROTECTION INSTALLATION
FINAL INSPECTION FORM

Sprinkler Contractor name and address	_____ _____ _____
Facility Inspected Building/System No./ Control Valve No.	_____ _____ _____
Inspection by: Name address phone	_____ _____ _____ _____ _____ PE or CET No _____

I have personally inspected the automatic sprinkler system referenced above and found it to be installed in accordance with the approved working drawings and associated review comments. The attached As-Built drawings and hydraulic calculations reflect the installation as it presently exists.

The following is the results of the main drain test conducted during my inspection:

Static Pressure: _____ Psig
Residual Pressure: _____ Psig

I certify that all areas of the building covered by the above referenced system have been protected in accordance with NFPA, Factory Mutual, and the project specifications, and all signs and placards have been installed.

_____ Date: _____
(Signed by PE or CET)

Comments or Exceptions: _____
_____
_____
_____
_____
_____
_____
_____
_____